Test Reflection – Exam 4

The fourth exam required us to use a combination of concepts learned throughout the class, from day one to present. We were to solve heat transfer problems using basic heat transfer formulas, such as $Q=\Delta T/\Sigma R$ and $Q=hA\Delta T$ and combining them with more complex experimental correlations. One of the keys to success is choosing the correct equations which is accomplished using the given geometry, material properties, and guessed and calculated values. This exam required a solid understanding of the class material and how all the concepts fit together.

In the first problem I had the set-up of the solution correct. I chose the correct heat transfer equations and had the correct thermal resistive circuit. While I chose the correct equation for determining h_o, I did not use the correct equation for h_i and did not have the correct Reynolds number. I believe this to be the reason my solution was not correct. My calculated h_o was 29.1 W/m^2*K while the h_o shown in the solutions was 28.175 W/m^2*K. However, my final calculated h_i was 702.1 W/m^2*K, approximately 480 off from the correct value of 1181.9 W/m^2*K. I also was off on the mass flow rate, as I calculated 2.15 kg/s while the correct flow rate was 3.5 kg/s.

The other issue that I had on this problem was having the incorrect mass flow rate. Since we did not know the mass flow rate at the beginning of the problem, I had to guess a value to calculate a velocity to be used in the calculation of the Reynolds number. Since I guessed a flow rate that was not even close to the correct value, I ended up with an errant Reynolds number which could have led me to the wrong Nusselt number equation. In hind sight, I should have taken the values from the same problem in the first exam, but I thought we were to try to solve on our own.

I struggled through the second problem on the exam. I feel that I understood the problem and had the initial set-up correct, however, I made some mistakes in the math to follow. The areas in all the equations were the same so I thought I could omit the areas but,

while I omitted them from the Q equations, I left them in the resistances which caused a math problem. My calculated Reynolds number matched the value in the solutions, however, it appears I chose the wrong equations to solve for h_{inf}, causing my solution to be incorrect. Once a wrong equation is chosen and a value calculated incorrectly it causes everything else to be incorrect even if you follow the procedure correctly.

I can see where these calculations could be valuable if you were dealing with refrigeration, AC applications or heat exchanger type situations. Knowing how to calculate the heat transfer rates, including that from solar radiation, and heat transfer coefficients could lead to properly designed systems with maximum efficiency for the given applications. In my current position I do not foresee myself needing to perform these types of calculations, but you never know what the future holds. I feel that at least having a better idea of the concepts discussed in this class could be of great benefit. I obviously had a hard time getting through this exam and, at times, was extremely frustrated but I feel that I have learned about the process required to solve such problems and will hopefully have a better handle on them for the future.

Grading Rubric	
Problem 1	
Thermal Circuit	1
Shape Factor	1
Nu eq for Internal flow	0
Nu eq for external flow	1
Use of Delta	1
Iterations	0.5
Surface Temp	0
Fluid Properties	1
Final Results	0
Total	0.611111
Probem 2	
Thermal Circuit	1
Energy Balance	0.8
Eq for Tso	0
Nu for External Flow	0
Iterations	0.5
Fluid Properties	1
Final Results	0
Total	0.471429
Final	48.71429